REMARKS

Claims 1-3, 5, 6, and 12-15 have been rejected under 35 USC §103(a) as obvious over Rock et al (EP 1 113 516 A1) in view of Reiser (Published U.S. Patent Application No. 2004/0157094) and Yang (Published U.S. Patent Application No. 2003/0203258). In addition, Claim 4 has been rejected as obvious over Rock et al, Reiser, and Yang and further in view of Edlund (U.S. Patent No. 6,495,277); Claims 7 and 9 have been rejected as obvious over the same three references, and further in view of Amrhein (Published U.S. Patent Application No. 2003/0124399) and Claims 8, and 10-11 have been rejected over the same three patents, and further in view of Bloomfield (U.S. Patent No. 3,976,507). However, for the reasons set forth hereinafter, Applicants respectfully submit that all claims which remain of record in the present application distinguish over the cited references, and are allowable.

The present invention is directed to a method for cold starting a fuel cell system that includes a heating device for heating a cooling agent that is circulated to a fuel cell stack by a coolant pump. According to the present invention, during a start up period, when the fuel cell stack is at an ambient temperature below the temperature at which it is capable of sustaining a normal operation, the fuel cell stack is operated with an output power that is "adequate to operate the heating device and the coolant pump", and the power generated in this manner is used for that purpose, so that the cooling agent, which has been heated in the heating device is circulated through the fuel cell stack. When the fuel cell stack reaches a preset temperature that is higher than the original temperature, the heating device is shut off.

In addition, Claim 1 has been amended to include the limitations previously found in Claims 13-15, which have been cancelled. Thus, Claim 1, as amended, further recites that the

fuel cell system includes a starter battery which is dimensioned "such that it has an output that is sufficient only to supply electrical power to the components necessary for the supply of reactants to the fuel cell stack until the fuel cell itself generates electrical power". Finally, Claim 1 as amended further recites that in a first stage, the starter battery initially supplies power to the auxiliaries necessary for supply of reactants to the fuel cell stack, and that such initial supply of power is interrupted when the fuel cell stack itself generates electrical power. Applicants respectfully submit that the latter features of the invention are not taught or suggested by the Rock et al reference.

That is, as discussed in paragraph [0013] of the Rock et al published European patent application, in order to heat the system, a sufficient quantity of oxygen is introduced into the hydrogen-rich feed stream (or vice versa) to exothermally chemically react the hydrogen and oxygen, thereby assisting in heating the electrode assembly to a temperature (at least approximately -20°C.) at which current can be drawn from the fuel cell stack and internal resistive heating of the stack begins. Preferably, the oxygen used for heating continues to flow until the stack has reached a temperature of approximately 0°C. to supplement the resistive heating below freezing. Also, thermal start up of the stack may further be affected by heating the coolant that normally circulates through the stack to cool it.

From this disclosure, item 1 of the Office Action infers that the initial output of the stack is adequate to operate a heating device (combustor) and a coolant pump (circulation means). However, Applicants note in this regard that, Rock et al contains no disclosure which teaches or suggests that the electrical power required for supplying sufficient oxygen into the hydrogen-rich feed stream, for operating the combustor to heat the coolant, and for

operating the coolant pump, is or may be drawn from the fuel cell stack itself. Rather, at Column 3, lines 2-5, Rock et al indicates simply that the electrical current drawn from the stack may be used "to assist in completing the heating of the fuel cell up to its normal operating temperature." Accordingly, it must be assumed that the system in Rock et al includes a battery with an output capacity sufficiently large to operate the oxygen supply, the internal resistive heating of the stack, the heating of the coolant and the circulation of the coolant to heat the fuel cell stack up to normal operating temperatures. The present invention, on the other hand, eliminates the need for such a battery.

In particular, as noted previously, Claim 1 as amended, recites that the starter battery is dimensioned "such that it has an output that is sufficient only to supply electrical power to components necessary for the supply of reactants to the fuel cell stack until the fuel cell itself generates electrical power". In the system according to the invention, there is no need for a large battery for the cold start process, even at sub-zero temperatures, because the heating of the fuel cell stack is done by the coolant circulating through the fuel cell, and the electrical power required for heating and circulating the coolant is drawn from the fuel cell stack itself.

The Reiser et al reference, on the other hand, discloses that melting of the coolant may be started by a heater (45) powered by a battery (80) or by circulating externally heated glycol (83). (See Abstract.) Moreover, in paragraph [0032], Reiser et al indicates further that the glycol solution coolant is selectively utilized in a cabin heater, and that, during start up when at least a portion of the cell stack assembly (19) may be at a temperature that is below freezing, the glycol solution is not circulated through the heat exchanger tubes (31). By way of contrast, in the present invention, a combustor is used as a heating device, instead of an

electrical heater, and the power provided by the fuel cell stack is used to operate the combustor as well as the coolant pump which circulates coolant, even at sub-zero temperatures. Thus, the present invention operates the heating device (combustor) as well as the coolant pump using the power output of the fuel cell, and the heating device does not heat the coolant by electrical power.

Accordingly, Applicants respectfully submit that the combination of Rock et al and Reiser et al does not yield the method according to the present invention, because such a combination would not include a cooling pump that is driven by the power generated by the fuel cell. Indeed, Applicants note that the Reiser et al reference actually teaches away from the solution provided by the present invention in that it expressly states that the coolant is not circulated through the heat exchanger tubes 31 at all at freezing temperatures.

Finally, the Yang reference teaches that power needed during start up at low temperatures must be originated from a battery. While it also indicates that the electricity drawn from the fuel cell stack can be used to recharge the battery, there is no teaching or suggestion of utilizing power generated from the fuel cell system itself in order to operate the heating device and the coolant pump during a start up time at an ambient temperature that is below the temperature at which the fuel cell stack is capable of sustaining a normal operation.

Accordingly, as recited in Claim 1 as amended, the present invention permits the starting of a fuel cell at sub-freezing temperatures using only a starter battery that has an output sufficient to supply electrical power to components that are necessary to supply reactants to the fuel cell stack until the fuel cell itself generates electrical power. None of the references cited in the Office Action, whether considered separately, or in combination,

teaches or suggests such a system. In this regard, Applicants note that a new Claim 16 has been added, which, while formatted differently, contains limitations that parallel those of Claim 1, as amended, including in particular the substance formerly included in Claims 13-15. Accordingly, Claim 16 is believed to be allowable for the same reasons set forth above.

In light of the foregoing remarks, this application should be in condition for allowance, and early passage of this case to issue is respectfully requested. If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket # 102063.56866US).

Respectfully submitted,

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